IMPACT OF RATE STRUCTURES AND RATE LEVELS

Memorandum of

ONTARIO HYDRO

to the

Royal Commission

on Electric Power Planning

with respect to the

Public Information Hearings

June, 1976

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14.0 IMPACT OF RATE STRUCTURES AND RATE LEVELS

14.1 INTRODUCTION

This memorandum provides background information on the pricing philosophy and methods used for the retailing of electricity in Ontario from the time of Ontario Hydro's formation to date. Also included is information on the more common pricing methods used elsewhere, or under consideration.

A major study on the costing and pricing of electricity, which commenced in early 1975, is currently being completed. The study covers four major areas: costing, pricing, demand elasticity and impact, and will be the subject of a special Ontario Energy Board hearing this fall. It is expected that the recommendations arising from the review and the report by the Ontario Energy Board to the Minister of Energy will be a major influence in establishing electricity pricing practices to be followed for the future.

Copies of the costing and pricing study will be forwarded to the Royal Commission on Electric Power Planning at the time of its submission to the Minister of Energy.

14.2 HISTORICAL BACKGROUND

From its inception in the late 1880's until well past the mid point of this century, electricity supply was a declining cost industry. Generally, as the size of the utility increased, the unit cost of production and supply decreased.

In the early years in Ontario, Sir Adam Beck demonstrated the advantages of abundant and reliable electrical service at low cost. This achievement, under public ownership, was held up as an outstanding example throughout the world. Subsequent publicly-owned agencies, such as the Tennessee Valley Authority and some of the other provincial utilities, were patterned in similar mold and also pursued a policy of low rates and widespread use.

The widespread use of electricity was encouraged through such means as the rural electrification program and programs demonstrating residential uses such as lighting, washing and cooking. Industrial plant applications where developed, particularly those related to the use of the electric motor to overcome the disadvantages of the central drive shaft, usually steam or hydraulically driven.

By encouraging widespread use of electricity through such programs the utilities were able to achieve the accompanying advantage of low rates. A well known American public servant, Leland Olds, aptly named this relationship "The Price-Use-Cost Spiral". He demonstrated that if the utility first lowered the unit price, an increase in consumption would follow, which in turn would result in a decrease in unit cost, which in turn would allow a lower unit price, and so on.

By the late 1960's, however, utilities were experiencing unprecedented cost increases. As a result, utility rates have been increasing significantly for the past several years.

Illustrations of the changing cost patterns in electrical supply, as reflected in the rates, are given in the following graphs:

Fig. 1(a) shows the change in average unit residential revenue (cents per kWh) for the municipal utilities, from 1955 to 1975, in terms of current dollars.

Fig. 1(b) shows the corresponding trend in average residential consumption over the same period.

Table 1 provides the statistical data for municipal residential customers on which Fig. 1(a) and 1(b) were prepared.

Table 2 provides similar data for the same period for general service customers (commercial and industrial) and municipalities.

Fig. 2 shows the trend in monthly electricity bills for municipal residential service at 750 kilowatthours per month from 1965 to 1976, expressed in cents per kWh.

Fig. 3 compares electricity bills, at 1,000 kilowatthours per month, of selected cities and communities in Canada and the United States. For Ontario, the Toronto Hydro bill represents the urban rate levels, while the Ontario Hydro R-1 bill indicates the rural rate level for the same consumption.

Figure 1(a)

AVERAGE RESIDENTIAL REVENUE PER kWh
- MUNICIPALITIES (1955 - 1975)

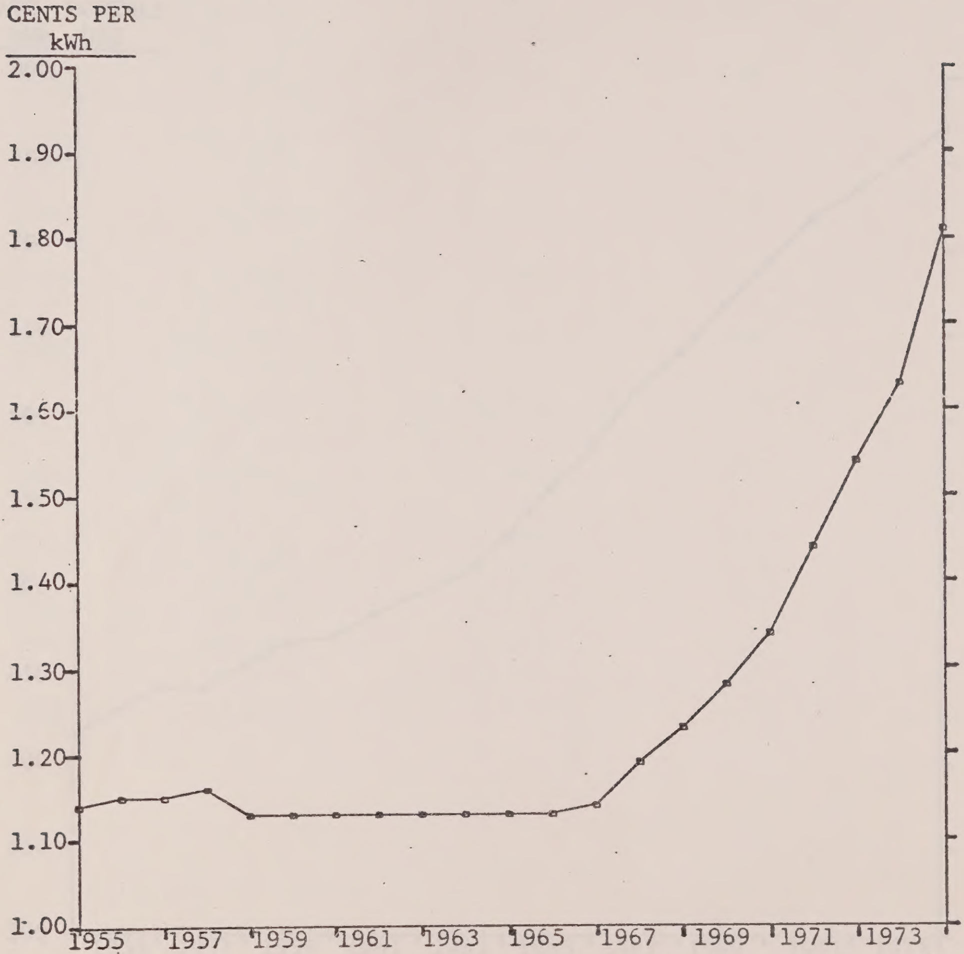


Figure 1(b)

AVERAGE RESIDENTIAL CONSUMPTION
- MUNICIPALITIES (1955 - 1975)

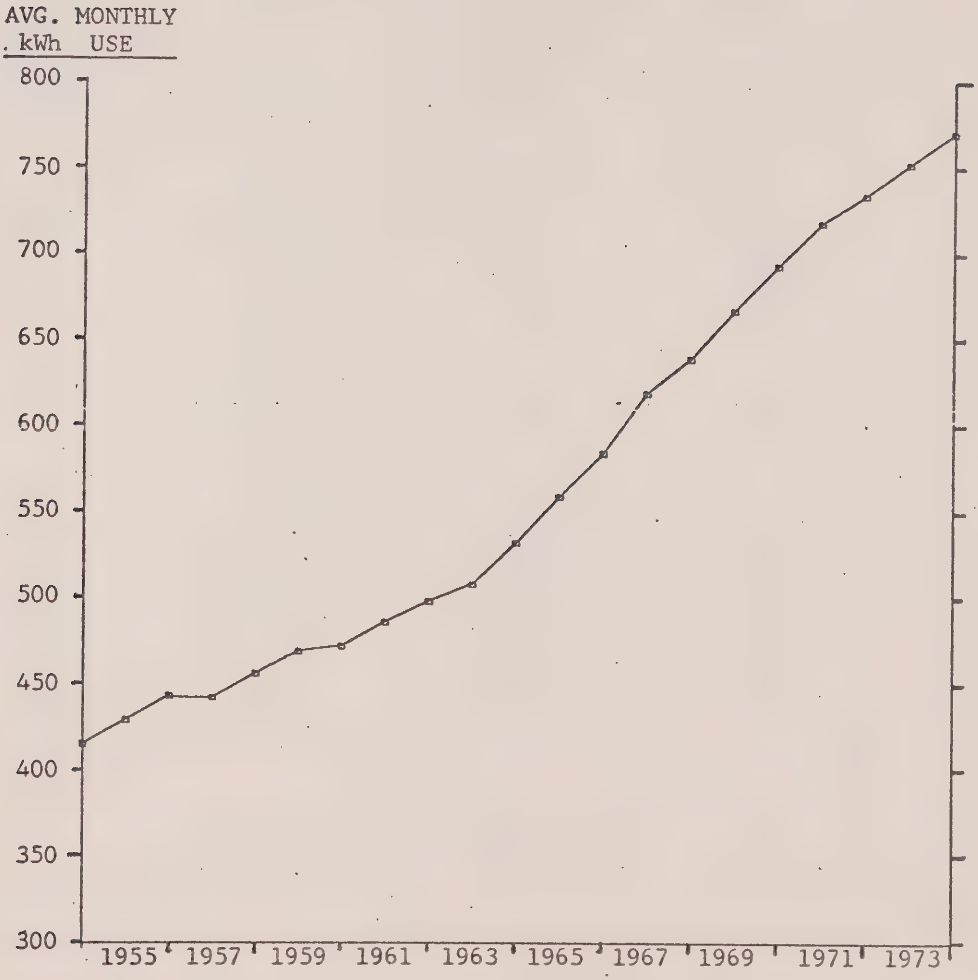


Table 1

MUNICIPAL RESIDENTIAL SERVICE

Year	Consumption (000,000 kWh)	Customers (000)	Monthly Av. Consumption per Customer	Average Cost per kWh
1954	4,247	931	380	1.20
1956	5,192	1,031	419	1.18
1958	6,036	1,139	442	1.16
1960	6,945	1,235	469	1.13
1962	7,853	1,346	486	1.13
1964	8,743	1,434	508	1.13
1966	10,103	1,506	559	1.13
1968	11,532	1,565	619	1.19
1970	12,723	1,596	667	1.28
1971	13,112	1,587	693	1.34
1972	13,776	1,613	718	1.44
1973	14,263	1,628	734	1.54
1974	14,812	1,654	752	1.63
1975	15,395	1,677	770	1.81

Table 2

MUNICIPAL GENERAL SERVICE

Year	Consumption (000,000 kWh)	Customers (000)	Monthly Av. Consumption per Customer	Average Cost per kWh
1954	5,784	146	3,301	1.16
1956	7,222	150	4,012	1.10
1958	8,097	145	4,653	1.10
1960	10,249	147	5,810	1.03
1962	12,339	145	7,091	1.00
1964	14,949	150	8,305	.97
1966	17,784	156	9,500	.97
1968	20,964	176	10,260	1.02
1970	24,894	198	10,890	1.08
1971	27,079	203	11,260	1.13
1972	30,154	209	12,215	1.17
1973	33,058	214	13,030	1.25
1974	34,897	218	13,445	1.33
1975	36,562	223	13,813	1.48

Figure 2

TREND IN RES. RATES AT 750 kWh/MONTH
- MUNICIPALITIES (1965 - 1976)

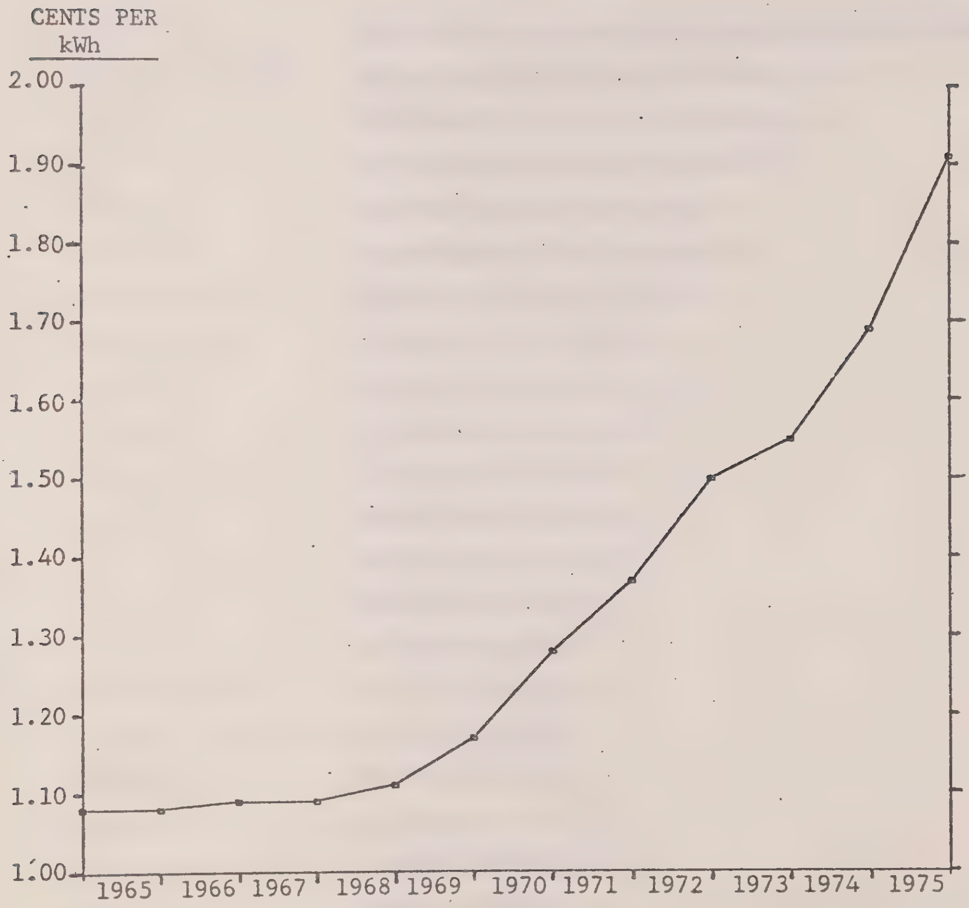
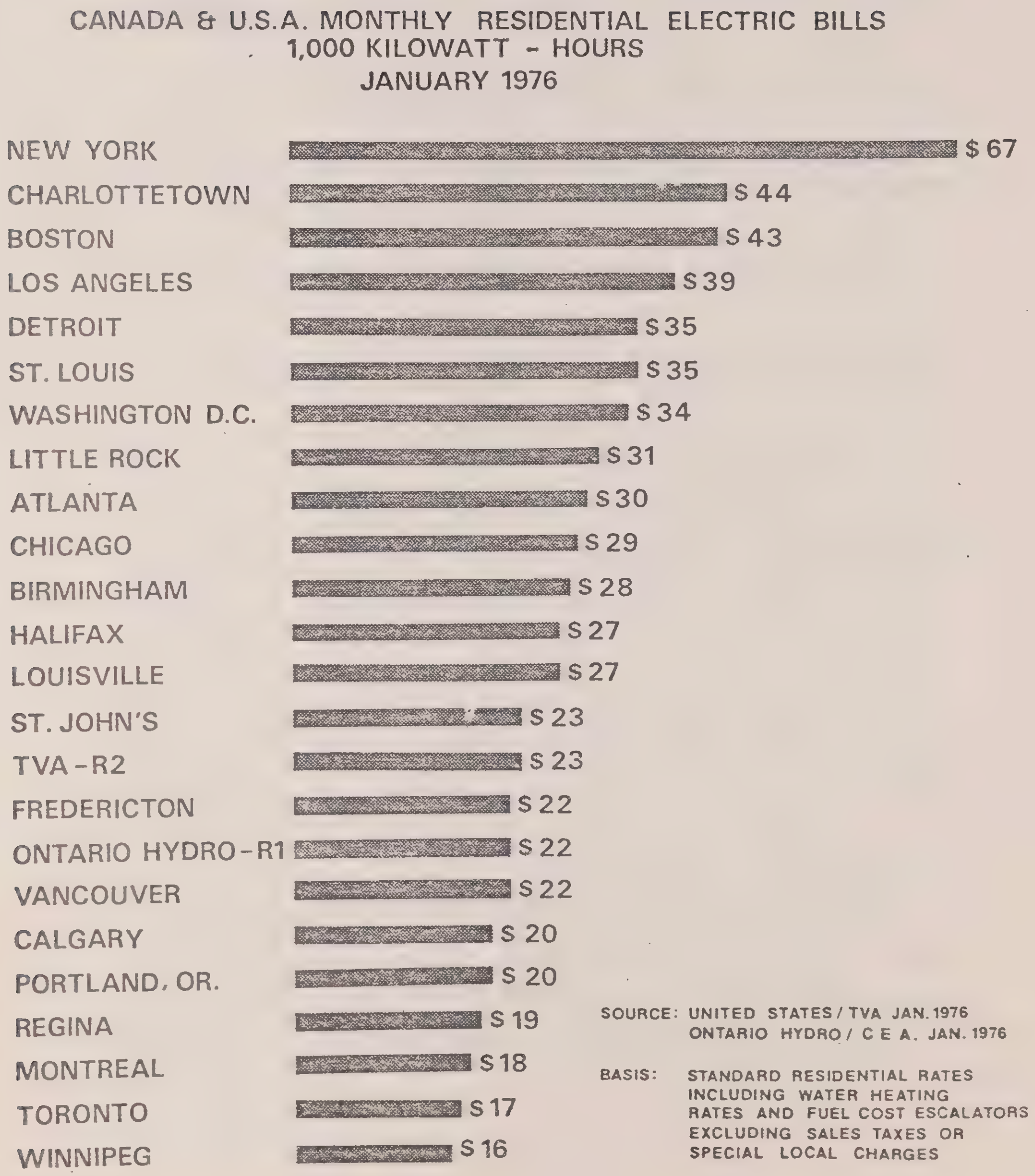


Figure 3


CANADA & U.S.A. MONTHLY RESIDENTIAL ELECTRIC BILLS
1,000 KILOWATT - HOURS
JANUARY 1976
NEW YORK $ 67
CHARLOTTETOWN $ 44
BOSTON $ 43
LOS ANGELES $ 39
DETROIT $ 35
ST. LOUIS $ 35
WASHINGTON D.C. $ 34
LITTLE ROCK $ 31
ATLANTA $ 30
CHICAGO $ 29
BIRMINGHAM $ 28
HALIFAX $ 27
LOUISVILLE $ 27
ST. JOHN'S $ 23
TVA - R2 $ 23
FREDERICTON $ 22
ONTARIO HYDRO - R1 $ 22
VANCOUVER $ 22
CALGARY $ 20
PORTLAND, OR. $ 20
REGINA $ 19
MONTREAL $ 18
TORONTO $ 17
WINNIPEG $ 16
SOURCE: UNITED STATES / TVA JAN. 1976
ONTARIO HYDRO / C E A. JAN. 1976
BASIS: STANDARD RESIDENTIAL RATES INCLUDING WATER HEATING RATES AND FUEL COST ESCALATORS EXCLUDING SALES TAXES OR SPECIAL LOCAL CHARGES

Naturally, the rate increases, together with concerns regarding environmental problems and the future availability and utilization of natural resources, have focussed a great deal of attention on both rate levels and form of rate structures.

A number of issues have been raised in this regard, including:

- the impact of the increased costs on persons with lower incomes;

- the effect of present rate structures and pricing policies on the efficiency of resource utilization;

- the overall depletion rate of non-renewable resources.

- external costs related to the environment and to the well-being and the health of the people.

Amongst the many possibilities being considered for rate structure revision is inversion of the traditional decreasing block energy rate to discourage growth and a change to peak load pricing techniques. Such revisions would be in addition to the publicly-owned utilities' basic obligations to keep rates as low as possible and to endeavour to maintain an equitable distribution of costs among customers.

Thus, rate levels and structures are being called upon to satisfy a number of objectives, many of which may be in conflict. For instance, it may not be possible to meet simultaneously the need to keep rates as low as possible, effect efficient utilization of resources, and achieve equitable distribution of costs. The problems of the design of rate structures are presently under study by Ontario Hydro, both on its own behalf and as a participant in a major study being conducted in the United States by the Electric Power Research Institute (EPRI) under the auspices of the National Association of Regulatory Utility Commissioners (NARUC).

14.2.1 General

The earliest pricing of electric service was a flat rate per light. When distribution of electricity was beginning in the 1880's, rates were introduced for electricity to operate arc lamps, for example 75 cents a night for the first light and 50 cents for each additional light.

These flat rates - so much per month per light or per customer or per room or per horsepower of connected motor loads - were originally prompted largely by lack of acceptable meters. They are still used when load and hours of use are both known or usage is insufficient to warrant metering, as with street lights controlled by photo-electric cells. However, flat rates only provide a rough indication of the amount of power being used. They can also create inequitities among the customers and may encourage waste. For these reasons flat rates are being used less and less.

With the wider use of meters, it was not unusual to apply the same price per kWh to all use. This method ignored any relationship between cost and usage. If the rate per kWh were high enough to cover fixed costs as well as incremental costs, it was too high to promote use and thus the appeal of simplicity gave way to more complex structures to reflect decreasing cost.

An alternative, introduced early, was a customer charge plus a single price per kWh. The main difficulty encountered with this form was that the customers felt that they were paying "something for nothing".

One of the early methods to encourage use was a discount for bills over a certain size. For example, a 20% discount was given on all charges in excess of $25 per month. The effect of this rate structure is almost identical to that of the block structure.

One of the schemes that failed was to charge one price per kWh if use was less than a specified amount and a lower price if use was greater. For example, if one customer used less than 50 kWh a month he was charged 15 cents per kWh, and a

customer who used more than 50 kWh a month was charged 10 cents a kWh. This approach was abandoned because the customer who used between 50 and 60 kWh paid less than one who used between 40 and 50 kWh.

Another scheme that rapidly lost its popularity was the so-called objective rate, which offered each consumer a price reduction for use over and above his consumption in a previous period. This led to a variety of bills for equal energy use, disgruntled customers and overworked billing clerks.

The rate structure which became most popular for smaller customers is the energy-block rate. In this structure one price per kWh is applied to the first part of a customer's use, and lower prices are charged for larger and larger additional use. The following is a simple example of a monthly energy-block rate:

First	50	kWh @ 5.0	cents
Next	200	kWh @ 2.5	cents
Additional		kWh @ 1.9	cents

Most energy-block rates include a larger number of energy blocks and prices.

In 1932 the Tennessee Valley Authority (TVA) introduced its basic residential rate:

First	50	kWh at 3.0	cents
Next	150	kWh at 2.0	cents
Next	200	kWh at 1.0	cents
Next	1,000	kWh at 0.4	cents
Additional		kWh at 0.75	cents

The 1,000 kWh block at 0.4 cents a kWh was then an extraordinarily low rate and was intended to stimulate additional uses of electricity. However, because it was not known that any and all additional use could feasibly be supplied at that price a final block was added and set at the weighted average of the previous blocks. This final block prevented the average price from dropping below .75 cents/kWh beyond 1,400 kWh per month. This rate continued to be applied in the TVA area for some 30 years.

The basic TVA residential rate was an early example of a type of energy-block rate that was subsequently

used rather widely, particularly to promote electric water heating.

With larger customers it becomes important to take demand, that is, the rate of energy use over a short period such as one-half hour, as well as energy into account in pricing. The demand component encourages the customer to operate at high load factor by avoiding unnecessarily high peak demands and to increase use in the low-use periods.

The most direct way to take demand into account is to include in the rate a demand charge as well as an energy charge. For example:

Demand charge:	$2.50 per kW of max mthly demand		
Energy charge:	First	50 kWh	@ 5.0 cents per kWh
	Next	200 kWh	@ 2.5 cents per kWh
	Additional	kWh	@ 1.5 cents per kWh

The demand-and-energy form of rate is sometimes called the Hopkinson rate, after a British rate expert, Dr. John Hopkinson, who proposed its use in 1892.

Another form which accomplishes somewhat similar results in a different way, with less obvious use of the kilowatt demand in the billing, is the "hours-use" rate. This is sometimes called the Wright rate, after another Englishman, Mr. Arthur Wright, who suggested this type of rate in 1896. For example:

First	100 kWh per kW of demand	@ 4.0 cents
Next	100 kWh per kW of demand	@ 2.0 cents
Additional kWh		@ 1.0 cents

These two types of rates - demand-and-energy and hours-use - in their simpler forms can give identical results for most consumers.

Also, the rate structure may include elements of both these types of demand-related rates. When it does, they are referred to as Wright-Hopkinson rates. For example:

Demand charge: $1.50 per kW of maximum monthly demand
Energy charge: First 100 hours-use @ 1.5 cents per
Second 100 hours-use @ 1.0 cents per
Balance kWh @ 1.0 cents per

Another structure used extensively in France and Britain is based upon time of use.

Electricite de France introduced marginal-cost pricing in the form of the "Green Tariff" in 1956 with the objective of improving the utilization of power system facilities.

The Green Tariff is applicable to industrial customers. It consists of both energy and demand charges. The peak period demand charge is applicable to contract capacity during the peak hours. Additional demand occurring at other than peak hours is billed at a discounted rate. When introduced, there were five levels of demand charges covering the peak period, winter normal hours, winter low hours, summer normal hours and summer low hours. Quantity discounts are also applicable to the demand charges. Energy charges were applied for each of the five time periods, for each voltage level and for each of 23 rate zones. For example, for Zone 10, this produced 125 combinations but only 68 different energy prices.

With the exception of the charge during peak hours, the energy charges are based on the running costs of the marginal generation increased by transmission losses for the various Rate Zones. However, the peak period energy charge includes capacity costs allocated apparently on a judgement basis between the peak period energy charge and the various capacity charges.

In the early 1960's the British Central Electricity Generating Board introduced a time sensitive bulk supply tariff largely for the purpose of improving system load factor. This approach was in turn reflected in the retail rates of the Area Boards (distributors).

Under the British system the domestic customer may choose between a general purpose rate, with or without a supplementary off-peak rate for thermal storage purposes, and a time-of-day rate known as

the White Meter Rate. The general purpose rate is a block-energy rate form with blocking by volume. However, some Area Boards apply a customer charge along with energy charges, e.g. in London the customer charge varies with the area of the residence.

The White Meter rate for domestic customers consists of two energy charges plus a customer charge: its day-time rate is slightly higher than the end rate of the general purpose tariff; its night-time rate is approximately equal to the off-peak rate of the general purpose tariff. The White Meter tariff contains one off-peak period, whereas the general purpose tariff makes available three off-peak periods with associated rates, thus making direct comparisons difficult. The customer is required to pay a meter rental charge for the general purpose off-peak service.

For non-domestic customers, demand charges are applied either monthly, annually or both. Energy charges are blocked by hours use. At the customer's request time-of-day metering may be installed and a lower energy charge or a rebate per kWh will be applicable to night use. Demand charges may vary monthly.

14.2.2 Ontario

14.2.2.1 Municipal Residential Rates

The early domestic structure consisted of a service charge which was based on floor area as a measure of lighting demand, and a low kilowatthour charge which was in accordance with the variations in wholesale power cost to the municipalities. In 1920 minimum bills were introduced. The floor area basis of service charge was abandoned in 1924 when extensive use of domestic appliances made lighting only a small percentage of total kWh used. In addition the existing rate structure did not appear "to distribute the costs equitably". At that time a 2-block structure plus a service charge came into being.

About the same time, when electricity was first being considered for space heating, a rate of $4.00 per horsepower per month of connected load, plus the

regular energy charges, was established to discourage its use for this purpose.

In 1933 objections to the residential service charge had reached a point where it was deemed to be unacceptable and was generally dropped.

The depression of the 1930's resulted in reduced growth, causing concern about the waste of developed hydraulic resources and the impact on electricity rate levels. This, coupled with the continuing objective of bringing the benefits of low cost electricity to the Ontario community stimulated interest in new uses. In particular, attention was focused on the electric water heater because of its storage capabilities (high load factor and therefore low cost). In 1934 a monthly flat rate, based on water heater element size, was introduced. Water heater equipment, including thermostats, insulation and controls, was improved and made readily available. There is no doubt that this approach was the major factor contributing to widespread use of electric water heating over a 30-year period. Today, the flat rate is questioned because of its tendency to encourage wasteful use of hot water and thereby electricity.

From the mid-thirties until 1956 only occasional adjustments were made. Changes to revenue were effected mainly through changes in kilowatthour rates rather than to the structure itself.

By 1956 the existing 2-block structure resulted in nearly 80% of energy sold being charged in the second block (beyond 60 kWh). The effect was the same as a service charge and a straight line energy rate, and did not recognize the economies of scale and the relationship between load characteristics and kilowatthour consumption. To overcome these problems a new 4-block structure was introduced. The block sizes chosen were identified with the use of particular appliances:

First block	- 50 kWh	- lights and small appliances
Second block	- 200 kWh	- range and refrigerator
Third block	- 500 kWh	- water heater
Fourth block	- over 750 kWh	- all additional use.

This was considered to be a "normal use" pattern. The third block carried the lowest rate, and the end rate was set to stabilize the unit cost per kWh at the average established at the 750 kWh consumption point and at a level sufficient to cover additional distribution costs.

About 1958 low cost natural gas had arrived from Western Canada and at the same time interest in electric heating was increasing. As a result, the prohibitive residential electric heating rate was replaced with a separately metered rate. Although the new rate was not prohibitive in the sense of its predecessor, it was priced higher than the residential end rate. Subsequently, the rate was lowered on the basis of first hand information obtained on the characteristics of the electric heating load.

In 1961, the size of the upper heating element of the dual-element water heater was increased to improve water heater performance, and a special billing demand, based on load research, was established for the flat rate charges. This was followed by a modification to the 4-block structure whereby the third block was made available only to customers with metered water heaters. The price of this block was lower in situations where water heater control was applied. Thus, the standard structure became the 3-block structure which exists today.

In the early 1960's an all-electric rate was introduced to aid the development of electric heating, and gradually adopted by the municipal utilities. This rate consisted of a simple 2-block structure which resulted in approximately the same charge as for the 3-block structure with the optional water heater block.

The 1960's may be described as a customer-oriented period. Developments in rates were directed mainly towards simplification and removal of inequitable features. A concerted move was instituted to ensure that the rates charged would result in similar bills for similar consumption patterns.

Since the end of the 1960's there has been a de-emphasis on promotional aspects of rates, in line

with the interest in conservation and economy. Today, very few municipalities offer an all-electric rate; the flat rate water heater service has also declined, in many cases being offered for existing installations only; and the special water heater block is being slowly phased out except where it is justified by the application of control.

14.2.2.2 Municipal Commercial Rates

The rate structures originally developed for commercial lighting in 1911 consisted of a two-rate charge based on kilowatthour consumption - a higher rate on "the first hour's daily use of demand," (30 hours per month) and for all additional consumption the same rate as that charged to house lighting customers. The demand was generally based on installed capacity. In 1920, a second block (70 hours use per month) and a minimum bill were added.

Various modifications resulting in a lack of uniformity among the municipalities took place over the years. In 1926 a new commercial lighting rate was introduced to coincide with the new domestic rate and to meet changing conditions of demand and supply. It was recognized that the character of the commercial load was somewhere between that of the domestic and the power uses. Therefore, the commercial lighting rate was placed between the power rate and the domestic lighting rate. It consisted of a demand charge based on connected load, a minimum service charge, a kilowatthour charge for the first 100 hours use per month of connected load equal to the first domestic kWh rate, and a second kWh rate equal to the second domestic kWh rate for all additional consumption.

In 1929, because commercial customers were using their loads longer each month, the second kilowatthour charge was reduced to place it between the follow-on rate of the power service rate structure, and the second rate of the domestic structure. Virtually no change in the commercial lighting rate structure took place between 1929 and 1956.

In 1956 a second 100 hours use kilowatthour block was introduced to recognize the flat characteristics and high level of commercial load during the

critical peak period (then 8:00 am to 6:00 pm) of the system, and to improve the coordination with the power service rate.

In the 1960's, simplification of rates was evidenced by the changes made in the commercial and industrial classes. It has become increasingly difficult to differentiate between commercial and industrial loads, leading to classification difficulties and inequities, so in 1965 a general rate was introduced to combine the two classes. Also, because of the availability of natural gas, it was considered necessary to embody promotional features in the rate structures while retaining the cost basis. This structure, which is in wide use today, consists of a block energy rate form for customers with demands under 50 kW and a gradual transition from a block energy rate to a demand-energy rate beyond this level. For the larger customers, a separate two-part demand-energy rate (Hopkinson rate form) is used to ensure a close match between the rate and the municipal utility's bulk power costs at all load factors, while maintaining a reasonable degree of coordination with the general rate. This rate form provides a more equitable sharing of costs and better understanding by customers.

The long existing 75% clause (customer billed at not less than 75% of previous demand) was a deterrent to the development of electric heating and air conditioning and while justified in a strict economic sense, it created a great deal of customer dissatisfaction. Also, the idea had evolved that individual customer characteristics were relatively less important than class characteristics, or those of the system as a whole. Consequently in 1967 the 75% minimum billing demand clause was replaced, at the option of the utility, with a nominal minimum charge per kilowatt of demand. (The 75% minimum billing demand was continued for very large customers.)

14.2.2.3 Municipal Industrial Power Rates

In 1909, it was decided to charge power users on a flat rate based on motor rating and time of use discounts. For low load factor customers, there was a differential rate (again based on motor rating) consisting of a service charge and a consumption

charge. In 1913, the flat rate method of charging was abandoned but the time discounts were retained. The new rate consisted of a service charge per horsepower of connected load, or maximum demand, and a consumption rate in 3 parts - consumption up to first 50 hours monthly use of demand, additional consumption up to second 50 hours use, and all remaining consumption. Discounts were allowed as follows:

Class		Discount
'A'	24 hours unrestricted	Nil
'B'	24 hours restricted	10%
'C'	10 hours unrestricted	10%
'D'	10 hours restricted	33-1/3%

10-hour use meant every day between 7:00 am and 6:00 pm except for the hour from noon to 1:00 pm. Under restricted use, between October 15 and March 1 no power could be taken for the hours varying from 4:30 or 5:30 to 6:30 pm (but subject to revision according to load conditions).

With slight variations (e.g. in 1915, addition of an 18-hour restricted-use class at a 25% discount, provision for summer and short term power contracts, provision that power be sold "when available" and in 1920, a change in all class discounts to 10%), the time rate classes continued until 1938. After this, power was generally sold on a 24-hour unrestricted basis, with no discount, but upon special approval restricted power (off-peak) could be provided at discounts approved by Ontario Hydro.

As described in the section on commercial rates, a general rate structure was introduced in 1965 for application to both commercial and industrial customers.

14.2.2.4 Rural Rates

Because of the special nature of rural districts served by Ontario Hydro, both in respect to type of customer and density, the rate features differed in certain aspects from those of the municipalities. The principal founder of Hydro, Adam Beck, saw the tremendous potential of electricity on the farm and in 1910 instituted an educational campaign.

Electrification was seen as providing enormous benefits in rural development. Except for the war years, when materials shortages and government priorities curtailed the rapid extension of lines in rural Ontario, promotional programs, combined with low rates played an important role. For example, in 1934, Ontario Hydro made available for rural consumers a special energy rate for long hour users of power where the extra use of energy could be obtained from existing facilities. This low rate was particularly intended for soil heating and water heating.

Also to aid the development of rural electrification in the province, the provincial government in 1921 undertook to subsidize 50% of the capital cost of constructing primary lines. The subsidy continued until 1969.

The first farm rate, consisting of a yearly service charge and a flat rate per horsepower, was introduced in 1911. In 1913 a metered kilowatthour rate was made optional. In 1916 a new rate was introduced consisting of a service charge based on the number of customers per mile of line plus a kilowatthour charge for metered energy on hours of use contract demand, controlled first by fuses and later (1931) by breaker size. This control feature was a deterrent to increased usage of electricity and was finally removed from all rural customers by 1961. In the case of the farm class the breaker associated rate was replaced with a coordinated rate structure consisting of a block energy rate for small customers and a demand rate for large customers.

For many years Ontario Hydro classified its retail system customers into hamlet, farm, commercial, power, street lighting and various miscellaneous services with different rate schedules and rate levels applicable in the various Rural Power Districts throughout the province. Service was given on the basis of a uniform service charge and a variable 2-block consumption rate.

At various times during the period to 1944, more and more of the cost of supplying rural electric service was transferred from the service charge to the consumption charge until the service charge was

finally eliminated in 1944. The reason for this change was the objection by the customers to "paying something for nothing".

In 1944, the Rural Power Districts in the province were amalgamated, with uniform rates applicable to each class of rural service, regardless of location. The rate structure remained virtually unchanged until during the late 1950's and early 1960's, when piecemeal adjustments took place periodically with the introduction of such things as high-density zones, special blocks for water heating, all-electric rates and separately metered electric heating and commercial cooking, etc. in a similar way to the developments in the municipal utilities.

In 1966 a new rural retail rate package was implemented. An overall objective was to reduce, where possible, application and administration problems. The package included a regrouping of residential customers into two groups only, the rates reflecting the difference in cost between high and low density zones. Also accomplished was an amalgamation of the commercial and industrial power rates into a common "General" rate.

During the period 1968 to 1975, numerous other changes in rates and structures were introduced to further reduce the number of classes and sub-classes facing the customers and to eliminate administration problems. Guidelines for annual rate revisions are currently formulated on broad terms. The objectives are a high quality of service at the lowest feasible cost, a fair distribution of cost among customers, promotional and social neutrality, simplicity and discouragement of wasteful use of energy.

14.2.2.5 Direct Industrial Rates

Since the beginning of Hydro, certain customers - mainly industries and mines - because of considerations of size, type and location, have been served directly by Ontario Hydro on a separate schedule of rates under individual contract. In the earlier years these rates were closely related to the wholesale charges applicable to the nearest municipal utility. However, as the cost of power to the municipalities became more uniform in line with the wholesale "pooling concept" the need for this

distinction disappeared and in 1966 uniform rates for large direct customers (over 5,000 kW) were established.

Up to 1935 in the former Northern Ontario Properties, and 1946 in the former Southern Ontario System, the direct industrial rate consisted of only a demand charge. This was replaced with a rate consisting of a demand charge plus an excess energy charge above 70% load factor. In 1966, the present Hopkinson form of rate was introduced, consisting of a demand charge and an energy charge. In setting the levels of the rate structure components, the basic consideration is that the combination of demand and energy rates produce the required revenue to recover costs of the class, while respecting the cost considerations by encouraging good load factor.

One of the principal objectives of the 1966 revisions was to establish a realistic and stable value for the energy rate in respect to the incremental cost of increasing system load factor. This value was influenced greatly by the fuel cost of the coal-fired generation plants ameliorated by the benefits of existing hydraulic plants. As it turned out the high inflation rate eventually experienced, and which was largely unforeseen, effectively upset this stability objective.

In the past few years the increase in fossil fuel generation has manifested itself in relatively higher increases in the energy cost component. In turn this significant change in the character of power system costs is being reflected in increasingly higher energy charges in the rate for direct industrial customers. The resulting impact, of course, falls more heavily on the high load factor customers. Since 1972, the demand charge has increased by 29% and the energy charge by 133%. With the changing mix of generation the method of allocating costs to the demand and energy components is being actively investigated.

In addition to regular rates, discounts have been available to encourage these large customers to take a portion of their power on an interruptible and schedule (daily off-peak) basis, thus saving generation capacity. Today, about 20% of the power sold to the 103 direct customers is interruptible,

while a very small amount of the off-peak category is purchased.

14.3 ALTERNATIVE RATE STRUCTURES

14.3.1 Residential Customers

Conventional Block Energy Rate

The conventional block energy rate is the most common rate structure. It is not, however, uniform in application. Rather, the number of blocks and the kilowatthours included in each may vary over a wide range.

The conventional practice is to price the energy blocks in a descending pattern with the initial blocks recovering the fixed costs of providing service in addition to the variable costs associated with consumption. From that point on the structure is priced to recover the variable costs only. Some utilities have established the length and the price of the blocks in relationship to a priority system of appliances. For example, the first block might be sized to include the average consumption for lighting, refrigeration, and small appliances, the second for ranges, the third for water heating, etc.

Inverted Rate Structure

The descending block rate structure has a promotional appearance. The inverted rate structure prices consumption in ascending order so that the average unit price increases with increased consumption. However, it is not certain that this approach would achieve the intended result of curtailing consumption since for a given revenue requirement the increases to the larger customers must be offset with corresponding decreases to smaller customers.

Lifeline Rates

This proposal makes a basic amount of electricity available at a lower price level, thus resulting in a form of inverted or balloon rate structure. One consideration when setting a lifeline rate is the

fact that families with lower incomes are not necessarily low electricity users.

Dual Rates

This term includes rates which charge a higher price to new customers or for increased use by existing customers. This method raises the question of whether any customer of a community-owned system should be given a vested right to a portion of the electric facilities that were built to serve all customers. Also, it would result in a complicated and changing rate system which would be difficult to administer. Furthermore, as existing facilities are replaced some customers would be subject to abrupt rate increases.

Peak Load Rates

Time-of-use rates are offered in some jurisdictions to encourage customers to shift consumption from the peak period to the off-peak period. The rate consists of a high energy charge for peak period consumption and lower energy charge for off-peak use. A multi-register meter with a time switch or control circuit is required to separate the customer's consumption into the time periods. The benefits derived from this scheme depend upon the cost of special metering and billing as well as the load characteristics of the system and the degree to which the customers will alter their consumption pattern.

Demand Rate

Demand billing has rarely been applied for residential customers because their loads are relatively small and homogeneous and the benefits are more than offset by the additional metering and billing costs.

Flat Rate

This name is generally used in conjunction with rates applicable to individual appliances, for example, water heaters and street lights. In Ontario the term is applied to applications which are unmetered. The flat rate is established from a knowledge of average consumption and demand

characteristics and is applied as if all customers used the same quantities. The rate may be graded by the size of the appliance, for example, by water heater element rating or the voltage of street lights. This rate form is criticized because it lacks any incentive to use electricity carefully.

14.3.2 Commercial and Industrial Customers

Block Energy Rates

For commercial and industrial customers similar in size to residential customers, conventional block energy rate structures are commonly used. These rate forms apply to levels of about 50 to 100 kW after which demand charges are also employed. The smaller customers have less flexibility in controlling their demands and the additional metering, billing, and control costs are substantial. The rate levels are somewhat higher and the energy blocks somewhat longer than those for residential service. The reasons given for this are: first, there is less certainty as to the demand characteristics of these customers; and second, the cost of serving the commercial and industrial customer is higher.

Demand Rates

Electrical energy cannot be economically stored in large quantities as it is necessary to construct sufficient system capacity to meet the system peak demands. Thus, if customers control their demands in such a way as to reduce the required plant capacity, or make better use of existing facilities, total costs, and therefore rates, will be reduced. Also, fairness requires that the rate system recognize the difference in cost created by low-demand high-consumption customers, and high-demand low-consumption customers. This objective is accomplished through the application of demand chaages in the rate structure and is a means of recognizing the significance of load factor in respect to cost of service. The determination of the actual demand charge is complex as the maximum demand of the customer is not necessarily coincident with the maximum demand on the power system or any particular component thereof. Generally, then, the practical compromise has been to bill the customer

on the basis of his individual maximum demand with the rate level modified to reflect coincidence with customer class and system peak demands.

As noted in section 14.2.1, the Hopkinson rate structure is a demand and energy form of rate that is widely used and consists of a charge per kilowatt of maximum demand and a charge per kilowatthour consumed. Either the demand charge or the energy charge may be blocked.

The hours-use or Wright rate provides for a demand charge in a somewhat different way. In this case an energy charge is levied which relates to the customer's maximum demand. In their simpler forms, both the Wright rate and the Hopkinson rate can provide identical results for most customers. A combination of the features of both the Wright rate and the Hopkinson rate is also used and is known as the Wright-Hopkinson rate consisting of a charge per kW of maximum demand and blocked energy charges based upon the hours use of maximum demand.

14.3.3 Other Rate Concepts

Time of Use Rates

The demands on the utility may vary because during portions of the day, season, or year customer loads may be higher than during other periods. It may be desirable therefore to charge higher prices during these periods of high use to encourage a more uniform use pattern and thus reduce the operating cost and the requirement for new facilities. At the same time increased energy use may result during the off-peak periods. The time feature could apply to either demand charges or energy charges or both.

There are two basic approaches to the application of time-of-use rates. A price differential may be incorporated in the regular rate structure or offered in the form of ancillary provisions such as a valley hour rates.

Interruptible Rates

Interruptible rates are offered for a lower level of service, with conditions as to the maximum frequency and duration of service interruptions being

specified by contract. In return for accepting this lower level of service which results in system savings, the customer receives a lower price. The lower price is generally in the form of a discount on the demand charge. In general, this type of service has been available to large industrial customers.

Special Rates

Some special equipment loads create less stress on the utility system due to their size and use characteristics. A particular application may be designed to operate in such a way as to complement system demands. In these cases, special rates have been applied. Such rates have usually only been offered to large loads, such as electric furnaces and irrigation pumping, and served through separate metering.

14.4 RATE STRUCTURE TRENDS IN HYDRO

As stated at the outset a major review of Hydro's costing and pricing policies and practices was commenced early in 1975. This review is still in progress and the policy decisions arising from the review will not be available for implementation in the 1977 rates. In the meantime, therefore, the present retail rate setting approach is being examined to determine what intermediate steps can be taken to meet the changing circumstances faced by Ontario Hydro and the municipal utilities and to aid conservation.

In a conservation context, any rate form which encourages waste or appears to encourage waste is undesirable. If a customer can use more electrical energy at no additional cost, the potential for waste exists and this is likely to happen. One such rate that still exists in Ontario is the flat rate for water heaters. As the result of Ontario Hydro's efforts 81% of the 265 municipal utilities having flat rates available in 1973 have now limited the application to existing customers. A further 13% of this total have now discontinued its application entirely. At this point in time further efforts are being taken to reduce the application of flat rates

for water heaters, particularly for uncontrolled service.

Also under the heading of special rates are rate structures designed for water heating and all electric customers. The water heater block was instituted to aid in the upgrading of water heaters to a higher standard and to offset the decreasing saturation of water heaters and thus avoid a situation whereby a high capacity distribution system would be under-utilized with a consequent upward effect on rates. The all-electric rate was introduced to provide an awareness of electric heating as an alternative to a conventional fossil fuelled heating system. As these objectives have in the main been met, and in consideration of the high priority placed on the conservation objective, these rate provisions are being eliminated in Ontario Hydro and the municipal utilities. For example, in 1973, 117 municipal utilities offered all-electric rates and 326 offered water heater blocks. By 1976 only 8 utilities with all-electric rates and 279 with water heater blocks remained and the phasing out program is being continued.

Also the present declining block rate structure has the appearance of a promotional rate. A concern has been expressed that customers find it difficult to respond to the need for conservation when such a rate structure is still in force. Therefore, to assist in encouraging customers to conserve energy, Ontario Hydro and the municipal utilities are currently considering methods for flattening the rate structure while maintaining a cost basis. This may be accomplished by applying a service charge and a single energy rate to residential and general class customers who are now billed on block energy rate structures. The service charge proposed for residential and small general customers is the amount required to recover the costs directly associated with providing service to each customer. There are four main elements of customer costs - billing, meter reading, meter capital and secondary service costs.

Valley-hour rate provisions as offered to the large direct customers of Ontario Hydro are being improved and extended to customers of the municipal utilities. Also, the terms applicable to

interruptible service in the municipal utilities are being made more attractive to encourage greater use in the longer term.

14.5 PRICE ELASTICITY

The relationship between electricity rate levels and customer use of electricity has been well demonstrated in North America at least under conditions of declining real prices. In the TVA area, for example, the average annual use per home, when the TVA Act was signed in 1933, was 600 kWh, about the same as the US national average. TVA introduced sharp price cuts and since then the retail rates for TVA have been around half the national average. The result, aided also by extensive power-use programs, was a spectacular rise in the use of electricity - to more than 14,000 kWh a year in the average home served by the municipal distributors of TVA power. During the same period the average residential use outside the TVA and Bonneville areas rose to about 5,500 kWh.

An analysis of the effect of a price reduction occurring at Chapleau after 1965 demonstrated the existence of the customers' response to price changes in Ontario. In 1965, the average annual use per home was 1675 kWh. After connection to the Ontario Hydro system there was an abrupt and sizable reduction in rates. The result was an increase in energy consumption per customer of 129% over a three year period, reaching 6,200 kWh by 1968. Over the same period the average consumption per residential customer in Ontario municipalities increased only 16%.

The history of the demand for electric energy in Ontario is one of falling prices in real terms. It is also true that the prices of utilization equipment, notably appliances, have also been falling in real terms. These factors, other things being equal, have stimulated the demand for electricity. However, the prices of alternative fuels have also been falling until recently. The decline in the price of gas after 1955 has been particularly dramatic. With the price of all major forms of energy falling in real terms until the early 1970's there has undoubtedly been a shift in Ontario towards more intensive use of all forms of

energy. About half of the growth in total energy demand in Ontario (excluding transportation use) can be explained by changes in Real Gross National Expenditure (GNE), which can be considered as capturing income and population changes. It seems reasonable to assume that the other half may be accounted for by changes in prices, technologies and attitudes towards the use of energy. Thus as the real price of all forms of energy rises, it seems likely that the demand for energy will grow less rapidly for given changes in GNE.

Today, the value judgements which the consumer must make are more difficult than ever before due to the uncertainty of future availability and cost of energy. In the past consumers made value judgements in their use of different forms of energy in an atmosphere of abundance. Today these judgements must be made under threat of potential scarcity. The question is being asked what effect will rate levels and rate structures have on the growth of electricity use.

The degree to which the changes in the real price, not only of electricity, but also of other fuels will affect the use of electricity is uncertain. Increases in the price of electricity will tend to reduce the demand for it, other things being constant. However, increases in the price of substitute fuels will tend to shift energy demand towards electricity in the absence of other changes. Consequently, the effects of price increases in all forms of energy are offsetting, subject to their combined depressing effect on the demand for energy generally.

It seems likely that oil prices in Canada will move to the international level and gas prices will move to heating content parity with oil. If such price movements offset the impact of the increased prices of electricity alone, then it would appear that electricity growth could be accelerated (apart from any total impact on energy demand in total). However, increasing energy prices in total tend to have an indirect effect on incomes, in that consumers seem likely to spend a higher proportion of their budget on energy and less on other things (such as appliances) in response to an increase in energy prices.

If a product has no close substitutes, its demand is likely to be inelastic. For example, demand for electricity which is used to operate a television set is probably very ineleastic, because no other fuel will bring the picture to the screen. In contrast, the demand for electricity for space heating is likely much more elastic because gas and oil are also available as heating fuels. In addition to substituting alternate fuels for space heating, customers can add more weatherstripping, storm windows and insulation, and accept lower room temperatures in reaction to increased prices and thus reduce the usage of electricity for space heating.

While the substitution effect is probably the most important single factor in price elasticity, other factors are important. These include: the essentiality of the service; the proportion of the buyer's income allocated to electricity; and the cost and durability of appliances.

The less essential the service, the easier it is for a buyer to curtail its use in the face of increased price. If the service is only a small fraction of the buyer's income, a price increase is not likely to affect consumption substantially. The larger the cost of the appliance in relation to the total cost of operating the service, the more inelastic the demand, for example, electric refrigerators. Finally, the durability of appliances and non existence of a secondary market postpones the reaction to increases in electricity prices.

As discussed, many proposals have been put forth for changes in rate structure design with the objective of lowering the rate of growth of electricity demand. It is recognized that structural changes which occur within a given revenue requirement result in higher bills to some and lower bills to others, causing some change in electricity consumption of individual customers, up and down. Very little is known, however, about the net effect of such changes. A recent study conducted at Cornell University and reported in a United States Federal Power Commission National Power Survey Task Force Report: "Power Generation: Conservation, Health, and Fuel Supply", March 1975 concluded that "...altering rate structures <u>ceteris paribus</u> will

influence the distribution of use between different classes and between different types of users within consumer classes. However, at the present time there is no evidence that rate structure revision in and of itself will affect aggregate levels of use."

This study however did not examine the effects of peak load pricing on aggregate electricity use except to observe "...a major advantage of peak load pricing is believed to be the impetus given to load levelling which in turn should result in higher load factors. To the extent that peak load pricing influences load factors but not aggregate sales, then there is only a modest effect upon total generation, fuel use, and environmental impact".

In context of load management it is almost certain that rate and service provisions can affect some reduction in peak demand by influencing usage patterns. One example in the residential sector is the application of off-peak rates and controls to storage water heaters.

In the commercial field where demand charges apply, example of existing customer load management opportunities include controlled water heaters to limit demands in apartment buildings and storage systems for space heating and cooling. Although these loads are controlled in relation to the customers' demand, the normal time of their demand is sufficiently coincident with the utility peak to achieve a significant reduction. Further refinement through control by the utility of these loads may not be justified.

In the industrial sector, opportunities for significant structural effects appear to be limited. The present structure with its significant demand charge has resulted in high load factors. Although for many years Ontario Hydro has offered off-peak and valley-hour rates, there has been very little demand for these services by industrial customers. At present only 11 MW are being taken. Apparently the other costs of manufacturing such as labour rates, production equipment and storage facilities are more significant than the price of electricity.

With interruptible rates the story if quite differ nt. Under these provisions the customer's

load is not interrupted on a daily basis but only infrequently under emergency conditions. At present Ontario Hydro supplies about 585 MW of interruptible load, or about 20% of the total load of the direct industrial customers (5,000 kW and over) served by Ontario Hydro. Further opportunities are currently being explored.

The rates applicable in the municipal electric utilities are reported periodically in the Ontario Hydro publication, "Monthly Rates and Comparative Bills Ontario Hydro and the Associated Municipal Utilities".

The following pages set out the rates currently applied to Ontario Hydro direct industrial and rural system customers effective from January 1, 1976.

SUMMARY OF RURAL RATES
EFFECTIVE FEBRUARY 1, 1976

RESIDENTIAL - YEAR ROUND (Quarterly Rates)	1R1-11	PR1-11 ER1-11	1R2-11	PR2-11 ER2-11
First 750 kWh-¢ per kWh	4.8	4.8	5.35	5.35
Next 1,500	-	1.7	-	1.7
Next 1,500	1.95	1.95	2.0	2.0
Balance	1.83	1.83	1.85	1.85
Minimum Monthly Charge	$4.00	$4.00	$4.00	$4.00

RESIDENTIAL - INTERMITTENT OCCUPANCY (Annual Rates)	1R3-11	1R4-11
First 240 kWh or less	$60.00	$60.00
Next 1,200 kWh-¢ per kWh	4.25	4.4
Next 1,560	2.2	2.35
Next 6,600	1.92	2.15
Balance	1.83	1.85
Minimum Annual Charge	$60.00	$60.00

FARM SERVICE (Monthly Rates)	1F2-11 1F2-13	PF2-11 PF2-13	1F2-31&PF2-31 1F2-33&PF2-33
Kilowatt Charge			
First 50 kW or less	-	-	-
Balance-per kW	$2.00	$2.00	$2.80
Energy Charge			
First 250 kWh-¢ per kWh	5.5	5.5	7.6
Next 500	-	1.7	-
Next 500	2.15	2.15	-
Next 8,750	-	2.0	-
Next 9,250	2.0	-	-
Next 9,750	-	-	2.35
Next 490,000	-	-	1.05
Next 1,500,000	-	-	.84
Balance	1.05	1.05	.7
Minimum Monthly Charge	$4.00*	$4.00*	$5.00*

GENERAL SERVICE (Monthly Rates)	1G2-11 1G2-13	PG2-11 PG2-13	1G2-31&PG2-31 1G2-33&PG2-33
Kilowatt Charge			
First 50 kW or less	-	-	-
Balance per kW	$2.80	$2.80	$2.80
Energy Charge			
First 250 kWh-¢ per kWh	7.0	7.0	7.6
Next 500	-	2.05	-
Next 9250	-	2.35	-
Next 9750	2.35	-	2.35
Next 490,000	-	-	1.05
Next 1,500,000	-	-	.84
Balance	1.05	1.05	.7
Minimum Monthly Charge	$5.00*	$5.00*	$5.00*

*Plus 25¢ per kW of maximum demand in excess of 50 kW established in previous 11 months.

A late-payment charge of 5% is assessed on the unpaid balance of current charges for metered energy, minimum bills, demand charges and fixed charge accounts.

MISCELLANEOUS RATES AND EQUIPMENT CHARGES
EFFECTIVE FEBRUARY 1, 1976

WATER HEATER EQUIPMENT
(existing heaters only)

Heater Size (Gallons)	Monthly Rental
40	$2.15
60	2.30
100	5.75

SENTINEL LIGHTS
(existing lights only)

Type of Service	Monthly Charge 175-Watt	400-Watt
Metered	$2.65	$2.90
Metered plus pole	3.65	3.90
Unmetered	4.30	6.50
Unmetered plus pole	5.30	7.50

SEPARATELY-METERED SERVICES
(rates restricted to existing services)

Residential Classes

Heating - HR1-11 - 1.83¢ per kWh
HR2-11 - 1.85¢ per kWh

Farm Class

Heating - HF2-11 - 1.85¢ per kWh

General Class

Heating HG2-11 & HG2-31 and
Cooking CG2-11 & CG2-31 - 2.35¢

CUSTOMER-OWNED THREE-PHASE TRANSFORMATION ALLOWANCE

	per KW
When Supplied at Utilization Voltage	-Nil
Primary voltage up to 49.9kV	-25¢
50 kV or over	-50¢

GUARANTEE UNITS
Applicable to Contracts Entered Into:

	Rate per Unit per Month
On or after Feb 1/76	$5.50
May 1/74 to Jan 31/76	4.50
Apr 1/60 to Apr 30/74	2.00
Jan 1/53 to Mar 31/60	.90

FLAT- RATE WATER HEATERS
(existing heaters only)

Element Wattage Upper/Lower	Monthly Charge
400/400	$3.46
450/450	3.89
500/500	4.32
550/550	4.75
600/600	5.18
650/650	5.49
700/700	5.78
750/750	6.12
800/800	6.41
850/850	6.71
900/900	7.04
950/950	7.37
1000/1000	7.68
3000/1000	8.16
1500/1500	11.52
4500/1500	12.24

Standby Service
For loads over 50 kW - Three-phase General rates to apply, subject to a special monthly minimum charge of 65¢ per kW and 50¢ per kW at Voltages up to 14.9 kV and over 15 kV respectively, based on the contract demand or maximum demand established when the service is used, whichever is the greater.

Emergency Service
Billed at Standard Three-Phase General Rate.

Service to X-Ray Equipment
50¢ per month per kVA of reserved or specially installed transformer capacity.

ONTARIO HYDRO

DIRECT INDUSTRIAL RATE

IN EXCESS OF 5,000 KW

FOR JANUARY 1, 1976

230 kV	Monthly Rate per kW	Yearly Rate per kW
	$	$
Firm	2.97	35.64
Interruptible "A"	2.18	26.16
Interruptible "B"	1.78	21.36
Scheduled "C"	1.54	18.48
Scheduled Valley-Hour	1.15	13.80
Excess	3.71	44.52
Standby Service	0.40	4.80

115 kV		
Firm	3.10	37.20
Interruptible "A"	2.31	27.72
Interruptible "B"	1.91	22.92
Scheduled "C"	1.67	20.04
Scheduled Valley-Hour	1.15	13.80
Excess	3.88	46.56
Standby Service	0.40	4.80

12 to 60 kV		
Firm	3.31	39.72
Interruptible "A"	2.52	30.24
Interruptible "B"	2.12	25.44
Scheduled "C"	1.88	22.56
Excess	4.14	49.68
Standby Service	0.55	6.60

Under 12 kV		
Firm	3.49	41.88
Interruptible "A"	2.70	32.40
Interruptible "B"	2.30	27.60
Excess	4.36	52.32

Plus 0.7 Cents per kWh for all energy used

Below 12 kV - Primary Distribution
12 - 60 kV - Subtransmission

INDUSTRIAL SERVICE DEPT.
DECEMBER 1975

ONTARIO HYDRO

UNIFORM NET MONTHLY FURNACE RATES

Class of Power	1st 100 Hrs. ¢/kWh	Next 100 Hrs. ¢/kWh	Next 300 Hrs ¢/kWh	Balance ¢/kWh
FIRM				
230 kV	1.59	1.38	1.17	.7
115 kV	1.63	1.41	1.19	.7
Subtransmission	1.71	1.48	1.21	.7
Distribution	1.77	1.54	1.23	.7
INTERRUPTIBLE "A"				
230 kV	1.40	1.19	0.98	.7
115 kV	1.44	1.22	1.00	.7
Subtransmission	1.52	1.29	1.02	.7
Distribution	1.58	1.35	1.04	.7
INTERRUPTIBLE "B"				
230 kV	1.33	1.12	0.91	.7
115 kV	1.37	1.15	0.93	.7
Subtransmission	1.45	1.22	0.95	.7
Distribution	1.51	1.28	0.97	.7
ADJUSTMENTS				
Interruptible "A" Discount	0.19	0.19	0.19	
Interruptible "B" Discount	0.26	0.26	0.26	

Effective: January 1, 1976

Prepared by:

Industrial Service Department
December 11, 1975